

REMARKS

Claims 1, 3-6, 10, 12, 14, 15, 25, 28, 29, 33, 36, 40, 42, 47, 50, 68, 76, 78, 81 and 82 are now pending in the application. Claims 1, 12, 29, 38, 40 and 76 have been amended. Claim 39 has been cancelled. Claim 83 is added as new. Support for the foregoing amendments can be found throughout the specification, drawings, and claims as originally filed. The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the amendments and remarks contained herein.

REJECTION UNDER 35 U.S.C. § 102

Claims 1, 3, 5, 6, 25, 38-40 and 42 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Lin (U.S. Pat. No. 4,748,453). This rejection is respectfully traversed.

Applicant has amended claim 1, 12, 29, 38, 40 and 76 to more clearly point out the claimed subject matter.

Claim 1 calls for “using radiation curable ink” in first and second passes. The subject application discloses that once it has been deposited on a substrate, then the radiation curable ink is cured by exposing the ink on the substrate to radiation. In some examples, the radiation comprises UV radiation, although other radiation could be used dependent on the ink type used. It is the exposure of the ink to the radiation which initiates a chemical reaction which turns the liquid ink into a solid.

The inventor of claim 1 recognizes that once the ink has been deposited onto the substrate, however, and before it is cured, the ink has a tendency to pull up from the surface, forming balls or ridges of ink which can lead to visible artefacts in the printed

image. Also, the inventor recognizes that it is often the case that the surface energy of the cured ink is different from that of the original substrate. Therefore, the behaviour of the ink droplet when deposited on the original substrate surface may be different from that of an ink droplet when deposited on the surface of a droplet which has already been deposited and cured onto the substrate. This may lead to further risk of surface artefacts being formed in the final print.

The inventor of claim 1 has surprisingly found that by carrying out a partial cure of the ink after printing, as in one or more embodiments of claim 1, the risk of the ink pulling up from the surface can be reduced, thereby reducing the risk or severity of print artefacts being formed. Also, by arranging for the partial cure to leave an exposed surface of the ink in non-solidified form, the behaviour of an ink droplet printed onto the ink in a second pass can be improved, for example by improving the wetting of the ink of the first pass by the ink of the second pass.

Applicant submits that Lin fails to teach or suggest the use of curable ink, particularly radiation curable ink. Lin at best appears to show that the ink dries (see column 4 lines 20 to 25) and does not set by curing as curable ink. In column 1 lines 33 to 47, Lin appears to show that the methods described in Lin relate to the printing of liquid ink. In other words, the ink in Lin comprises a dye in a carrier liquid. The ink dries by the driving off of carrier liquid, leaving only the dye on the substrate. Thus, Applicant submits that the ink of Lin differs from the claimed "radiation curable ink", in which the setting of the ink involves the chemical reaction or crosslinking of its components to form an ink film. In some (but not all) curable inks there may be little or no solvent (or "carrier liquid") and thus substantially no "drying" during the cure reaction.

Applicant respectfully traverses the Examiner's assertion that Lin, referring to col. 4, Ins. 15 and 23-24, teaches that the ink "begins to cure in 0.1-0.2 seconds". At col. 4, Ins. 21-25, Lin states that "[w]e know that on a transparency film the liquid ink takes longer to dry and that it will take about 0.1 to 0.2 seconds after deposition for an ink drop to be sufficiently tacky to receive an overlapping drop without beading." Applicant can find no disclosure or suggestion of curable inks in Lin.

Applicant initially submits that curable inks differ from solvent or "drying" inks of the type described in Lin, and different considerations apply to their application to a substrate.

In view of the foregoing, Applicant submits that Lin fails to anticipate claim 1.

In his rejection to claim 12, the Examiner asserts that one of ordinary skill in the art would be motivated to modify Lin to use radiation curable ink based on the teaching of Roth. Applicant respectfully traverses the Examiner's assertion.

Applicant submits that Roth does not appear to teach or suggest depositing a second pass of ink on an area as recited in claim 1. Thus, claim 1 defines over Roth.

Further, Applicant submits that one of ordinary skill in the art would not be motivated to modify Lin based on the teaching of Roth to arrive at claim 1. Applicant further submits that the Examiner fails to provide clear articulation why claim 1 would have been rendered obvious.

Lin and Roth appear to relate to different fields: one to curable ink and the other to solvent-based "drying" ink. Thus, one of ordinary skill in the art looking to improve print quality in printing with curable ink would not combine Lin and Roth as suggested by the Examiner.

Claim 1 further calls for "partially curing ink deposited in the first pass such that an exposed surface of the partially cured ink is in non-solidified form." In contrast, Lin appears to solve the problem of droplets of ink bleeding or blending together. Lin appears to show carrying out two passes of printing, the droplets of each pass being separated from each other and the time taken between passes being sufficiently long that the ink has dried enough for the risk of bleeding to be reduced. In other words, Lin appears to show carrying out a full cure of the droplets between passes to minimise the risk of bleeding of the ink. Thus, Lin appears to teach away from carrying out a partial cure as it would be understood to be likely to lead to an increase in bleeding effects, which is a problem Lin specifically seeks to overcome. Therefore, Applicant submits that one of ordinary skill in the art would not be motivated to modify Lin by partially curing curable ink in the first pass.

Equally, Applicant submits that Roth appears to solve the problem of the ink being partially cured. Roth appears to show a technique, in which the printed ink is transferred from one surface to another (column 2 lines 38 to 49) to expose the underside of the printed ink, to obtain full cure of the ink. Roth appears to show that in the first curing step, the ink is "at least partially cure[d]" (column 2 line 44 and elsewhere; emphasis added) and in some arrangements the ink is fully cured in the first printing step (column 4 line 52). Thus, it appears that the invention of Roth seeks to provide a method for more thoroughly curing radiation curable ink. Thus, Applicant submits that Roth also fails to teach or suggest partially curing the ink. One of ordinary skill in the art would not be motivated to modify Lin to arrive at partially curing the ink on the substrate based on the teaching of Roth.

Furthermore, Roth states that "the degree of cure decreases with increasing depth within the ink layer" (column 1 lines 17 and 18) and that "UV curable inks ... suffer from surface cure" (emphasis added; column 2 lines 8 to 10). In other words, the inks suffer from being cured at the surface but not beneath. Thus, one of ordinary skill in the art cannot modify Lin to arrive at partially curing ink so that the exposed surface of the partially cured ink is in "non-solidified form" as recited in claim 1 based on the teaching of Roth.

In view of the foregoing, Applicant submits that claim 1 and its dependent claims 3-6, 10, 12, 14, 15, 25, 28, 33, 36, 81 to 83 define over the art cited by the Examiner.

Claim 38 has been amended to similarly recite one or more of the distinguishing features of claim 1. Claim 39 has been cancelled. Applicant submits that claim 38 and its dependent claims 40, 42, 47, 50 and 68 define over the art cited by the Examiner for one or more of the reasons set forth above regarding claim 1.

REJECTION UNDER 35 U.S.C. § 103

- A. Claim 4 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin (U.S. Pat. No. 4,748,453) in view of Hetzer (U.S. Pat. No. 5,883,648).
- B. Claims 10, 12, 14 and 47 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin (U.S. Pat. No. 4,748,453) in view of Roth (U.S. Pat. No. 6,354,700).

- C. Claim 15 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin (U.S. Pat. No. 4,748,453) in view of Lutz (U.S. Pub. No. 2002/0009553).
- D. Claims 28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin (U.S. Pat. No. 4,748,453) in view of Nakagawa (U.S. Pub. No. 2002/0070997).
- E. Claim 33 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin (U.S. Pat. No. 4,748,453) in view of Cleary (U.S. Pat. No. 6,457,823) and further in view of Hu (U.S. Pat. No. 6,447,112).
- F. Claims 36 and 68 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin (U.S. Pat. No. 4,748,453) in view of Nakamura (U.S. Pat. No. 6,129,464).
- G. Claim 81 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin (U.S. Pat. No. 4,748,453) in view Nakai (U.S. Pat. No. 4,910,116).
- H. Claim 82 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin (U.S. Pat. No. 4,748,453) in view Nakai (U.S. Pat. No. 4,910,116) and further in view of MacQueen (U.S. Pub. No. 2003/0129369).

These rejections are respectfully traversed.

Applicant submits that the above claims depend directly or indirectly from one of claims 1 and 38 and thus the arguments present above regarding claim 1 apply here equally. Therefore, Applicant submits that the above claims define over the art cited by the Examiner.

Applicant further notes that the reference to Nakai given by the Examiner in relation to claim 81 does not appear to be correct.

- I. Claim 29 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin (U.S. Pat. No. 4,748,453) in view of Nakagawa (U.S. Pub. No. 2002/0070997).

This rejection is respectfully traversed.

Applicant has amended claim 29 to include the feature of radiation curable ink and further to include applying a second pass of ink onto the ink of the first pass, where are similarly recited in claim 1. Thus, Applicant submits that one or more of the arguments presented above regarding claim 1 apply equally.

The Examiner acknowledges that Lin fails to disclose that the ink of the second pass would substantially wet ink of the first pass, but asserts that one of ordinary skill in the art would be motivated to modify Lin based on the teaching of Nakagawa to arrive at claim 29. Applicant respectfully traverses the Examiner's assertion.

At paragraph [0096] referred to by the Examiner, Nakagawa at best appears to discuss how in conventional systems, there is the problem that ink from one pass can bleed into ink from a subsequent pass. Paragraph [0098] at best appears to discuss how in an embodiment of the invention of Nakagawa one pass of ink is in fact spaced apart in time from the second pass to reduce the risk of bleeding. Nakagawa appears to relate to the provision of mask patterns and printing procedures to reduce the risk of bleeding of ink of different scans. Thus, Nakagawa fails to teach or suggest a curing step being carried out on the ink to immobilize droplets as recited by claim 29.

In view of the foregoing, Applicant submits that claim 29 defines over the art cited by the Examiner.

- J. Claim 76 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hu (U.S. Pat. No. 6,447,112) in view of Cleary (U.S. Pat. No. 6,457,823).
- K. Claim 78 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hu (U.S. Pat. No. 6,447,112) in view of Cleary (U.S. Pat. No. 6,457,823) and further in view of Stowe (U.S. Pat. No. 6,454,405).

These rejections are respectfully traversed.

Claim 76 has been amended to be dependent on claim 38 and thus claim 76 and claim 78 define over the art cited by the Examiner at least for the same reasons set forth above regarding claim 38.

NEW CLAIMS

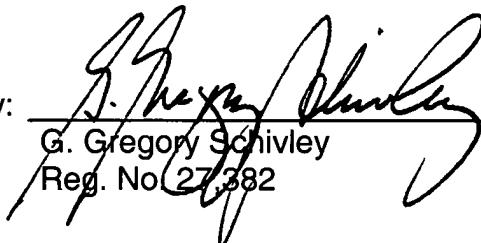
Claim 83 is new and depends from claim 1. Applicant submits that claim 83 defines over the art cited by the Examiner at least for reasons set forth above regarding claim 1.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action and the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

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